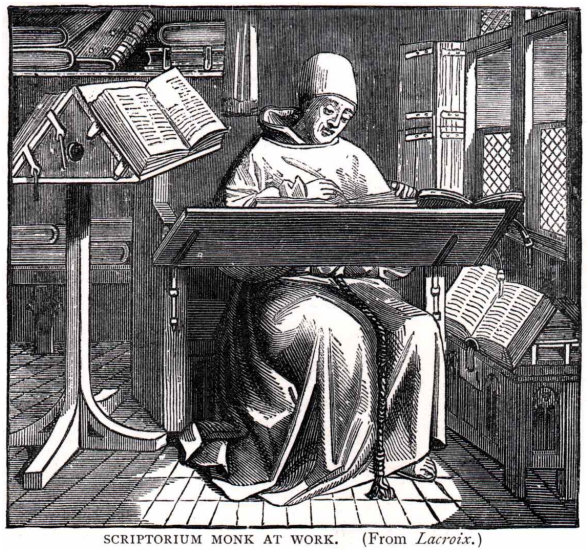
Writing Well [in NLP & ML]



SCRIPTORIUM MONK AT WORK. (From *Lacroix.*)

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Slides adapted from Chris Dyer.

Bad at writing?

- Writing is a skill:
  - You will get better by practicing it
  - You will get better by getting feedback
  - You will get better by reading **good writing**!
- Not a native English speaker?
  - ***Not a problem!***
  - Good research writing is about **good ideas** and **clear thinking**, not a big mental lexicon

Your Job as a Writer

- **You are writing for your readers.**
  - To teach your reader something you figured out
  - To convince your reader of something
- You are **not** (primarily) writing for **you**
  - ***Not your job: to show how clever you are***
  - It is okay to be wrong—it is **not** okay to be unclear
- Okay … you are kind of writing for you
  - Writing helps you clarify your ideas
  - Writing lets you get feedback from others

Your Idea

- Figure out what **your idea** is
- Make sure the reader knows what your idea is. **Be 100% explicit.**
  - *"The main idea of this paper is…"*
  - *"The goals of this article are to characterize the core ideas of X and provide a taxonomy of various approaches."*
  - *"In this section we present the main contributions of this paper…"*
- This belongs at the very beginning of the paper
- Good ideas that are not distilled = bad paper!

Who is Your Reader?

	blog or arXiv post	conference paper (or this class's report)	journal article	dissertation or book
Other readers?	Practitioners, other researchers working on the same problems	Researchers working in the conference's field's related problems	Researchers working on other problems in the (sub)field	Someone from the broader field (e.g., CS)
"Future you"	2 months	6 months	2 years	10 years
Length	1+ pages	8-10 pages + appendix	10-30 pages + appendix	100+ pages
Notes	Will the work be useful to someone and not embarrassing to your future self?	Assuming common ground in terms of "what's hot" is typical, but narrows readability.	Not used widely right now in NLP.	Everything must be explained in terms of stable common ground. (One must be fairly advanced to know what this is!)

Structure [conference paper]

- Title (1000 readers)
- Abstract (4 sentences, 100 readers)
- Introduction (1 page, 100 readers)
- The problem (1 page, 10 readers)
- The idea (2 pages, 10 readers)
- The details (5 pages, 3 readers)
- Related work (1-2 pages, 10 readers)
- Conclusions and further work (0.5 pages)

Imagine Your Reader

- Knowing your reader will let you determine
  - What notation are they familiar with
  - What level of detail will be appropriate
  - What terminology will be appropriate
- **Respect** your reader
  - Don't overclaim!
  - Don't bore your reader – ***get to the point***!
  - Organize your writing logically – *don't make the reader work more than necessary*!
  - People can be (irrationally) attached to their theories, methods, models – *don't be too harsh*!
  - Establish common ground, but don't belabor

Pitfalls when Imagining Your Reader

- Do ***not*** overestimate your readers
  - We are ***not*** as knowledgeable as you!
  - We are ***not*** as clever as you!
  - We have ***not*** read everything you have read, or as carefully!
  - We will read your paper in **minutes**, **hours**, or **days** … *You have worked on it for **weeks**, **months**, or **years**!*

Writing for a Reader: Questions

- Are you introducing a new problem?
  - Is the problem obviously important?
  - Do you need to convince them it's important?
- Are you introducing a new technique?
  - Benefits relative to alternative techniques
  - Costs relative to alternative techniques [be honest]
- What is difficult to understand?
  - Algorithms [correctness, complexity]
  - Theorems [proofs, intuitions]
  - Models [assumptions]

For Example

- Pick examples that
  - Illustrate the easy case easily
  - Illustrate the simplest complicated case easily
  - Are **concrete**

John	proved	correctness
PN	VBD	NN

is better than

w1	w2	w3
t1	t2	t3

- Use a running example
  - Return to the same example throughout the paper
- Structure
  - Concrete → abstract

An ounce of intuition is worth a pound of formalism!

Structuring a Paper

- Start with the known, move to the new
- Starting out
  - Identify a practical problem in need of solving
  - Identify an example illustrating some unexplained phenomenon
    - unexplained pattern of results
    - inconsistency between theory and reality, or among existing theories or findings
- Progress logically to new material
  - What is your proposed solution/explanation?
  - How do you express your solution formally and in relation to past work?
  - Why did you choose this solution?
  - What did you do to realize this solution (experiment, proof, etc.)?
  - Results
  - Analysis

Structuring a Paper

- What is logical structure?
  - Getting you to the idea/insight/contribution in the most direct way
- What is ***not*** logical structure?
  - Recapitulating how you (or the field) got to an idea
    - Don't make your reader suffer the way you did!
    - Example:
      IBM Model 3 was invented several years before **IBM Model 1** [numbering models is not always great]
  - Building a paper around your own anxieties

The Introduction

$$max\_intro\_pages = \sum_{i=1}^{\log_2 \frac{total\_pages}{4}} \frac{1}{i}$$

- Identify the problem you are solving
- **Clearly list your contributions**
  - Your contributions drive the structure of the whole paper
  - **For a survey paper**: Your contribution is a convenient way of understanding a bunch of related techniques / problems
- For an 8-page paper: intro gets **one page**
  - *No, your paper is not special*

Do not make the reader guess what your contributions are!

No “the rest of this paper is …”

- Not:

> “The rest of this paper is structured as follows. Section 2 introduces the problem. Section 3 … Finally, Section 8 concludes”.

- Instead, **use forward references from the narrative in the introduction**.
  The introduction should give a road map of the whole paper, and therefore forward reference every important part.

The most common of these approximations is the max-derivation approximation, which for many models can be computed in polynomial time via dynamic programming (DP). Though effective for some problems, it has many serious drawbacks for probabilistic inference:

1. It typically differs from the true model maximum.
2. It often requires additional approximations in search, leading to further error.
3. It introduces restrictions on models, such as use of only local features.
4. It provides no good solution to compute the normalization factor $Z(f)$ required by many probabilistic algorithms.

In this work, we solve these problems using a Monte Carlo technique with none of the above drawbacks. Our technique is based on a novel Gibbs sampler that draws samples from the posterior distribution of a phrase-based translation model (Koehn et al., 2003) but operates in linear time with respect to the number of input words (Section 2). We show that it is effective for both decoding (Section 3) and minimum risk training (Section 4).

Problems of standard approach that they are solving.

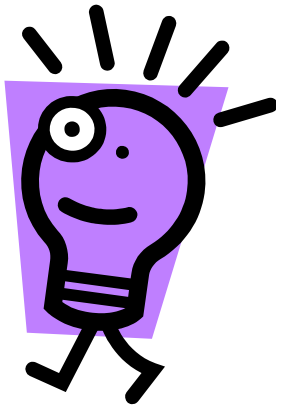
They didn't mention the conclusion!

Structure [Conference Paper]

- Abstract (4 sentences)
- Introduction (1 page)
- ~~Related work~~
- The problem (1 page)
- My idea (2 pages)
- The details (5 pages)
- Related work (1-2 pages)
- Conclusions and further work (0.5 pages)

No related work yet!

Related work



Your reader

Your idea

We adopt the notion of transaction from Brown [1], as modified for distributed systems by White [2], using the four-phase interpolation algorithm of Green [3]. Our work differs from White in our advanced revocation protocol, which deals with the case of priority inversion as described by Yellow [4].

No related work yet!

- Problem 1: the reader knows nothing about the problem yet; so your (carefully trimmed) description of various technical tradeoffs is absolutely incomprehensible
- Problem 2: describing alternative approaches gets between the reader and your idea

How to Write about Related Work

1. Make your laundry list/annotated bibliography version cites **all the things**. Tuck it at the end of the paper.
2. As you write, **move** citations from the laundry list into the paper.
   - The most important papers your paper is "conversing with" go in the introduction.
   - Papers that are part of your narrative should be smoothed in where they fit naturally (problem, idea, details, …).
3. Finally, smooth the "unmatched socks" into a coherent, organized related work section that discusses more distant works and larger context, also potential confusions.
   - *Dyer et al. (2013) use similar terminology to refer to a different idea in a different context …*

Tips for Good Writing

Get Started

- Writing is the best way to develop your ideas
- You may not have a completely focused idea when you **start**, but you **must** have a completely focused idea when you **finish**.

Ask People for Help

Get your paper read by as many colleagues and friends as possible!

- Explain what you want (“**I got lost here**” is much more important than “bayes should be capitalized”.)
- **Suggestion**: Ask your reader to explain your contribution back to you. Did they get it right?
- An expert can check details, but the logic of any paper should be comprehensible to a non-expert.
- **Remember**: Each reader can only read your paper for the first time once!

To Hedge or Not to Hedge?

- Empirical science is about failing to refute an idea, ***not about proving that an idea is correct***.
  - Your language around conclusions should signal your awareness of this, e.g., “we have found evidence supporting …” never “we proved that …”
  - Writing guides advise caution in making scientific assertions.
- Don’t hedge on established facts!
  - Leave your beliefs out of it; focus instead on the reasons for those beliefs.
  - Watch out for verbs like *believe* and *seem.*
- If you overdo it with hedging language, your reader will get tired; use workarounds that state facts when you can, for example:
  - Your hypotheses: “our conjecture is that …” or “we hypothesize that …”
  - Explanations: “a possible explanation is …”
  - Open questions: “future work could explore …”

Advice: Verbs

- ***Present / describe*** and friends. *We now present the wombat feature*... Did you invent it? Are you reviewing it? **Present** is ambiguous. **Use a non-ambiguous verb!**
- **Use strong verbs**. "*We introduce the novel GAGA algorithm*" is stronger than "*We propose the GAGA algorithm.*" Good verbs: **introduce, validate, verify, demonstrate, show, prove**
- **The passive voice is okay, really!**

Advice: Nouns

- Avoid **pronoun this**. "*This raises questions…*" Prefer instead **demonstrative this**: "*This pattern of results raises questions…*"
- (Smith et al., 2012) is **not** a noun. However, *Smith et al. (2012) offered an intriguing solution to the problem of nouns*.

Advice: Adjectives & Adverbs

- Avoid value-judgment adjectives. Bad:
  - We introduce an important algorithm.
- Good [**verifiably true**]:
  - We introduce a novel algorithm.
- **Better** [**true and precise**]:
  - We introduce a novel, polynomial time decoding algorithm using a linear program relaxation of the ILP.
- Use adverbs ***sparingly***.

Advice: Discourse Connectives

- The end of every sentence is an opportunity for a reader to get bored and give up.
- Discourse connectives signal the logical relationship that the next sentence will have to what came before. This keeps them going:

However,
As a result,
Therefore,
Similarly,
On the other hand,

- Using the *wrong* discourse connective will confuse your reader.

Use simple, direct language

NO	YES
The object under study was displaced horizontally	The ball moved sideways
On an annual basis	Yearly
Endeavour to ascertain	Find out
It could be considered that the speed of storage reclamation left something to be desired	The garbage collector was really slow

Polish

- There are hundreds of little conventions good writers follow, often compulsively, such as:
  - Spelling, punctuation, grammar norms, the difference between “e.g.,” “i.e.,” and “cf.”
  - Citation styles (e.g., know where the parentheses go)
  - Mathematical notation
  - Use of italics, boldface, abbreviations, …
  - Managing tables and figures: self-contained, clear captions; references in the main text; ease of reading; font size; color-blind-friendly palettes, …
- Making these things perfect will not save an unclear paper!
- But a lack of polish **will** distract readers from your ideas and make it harder for them to trust you.
- Internal consistency (which shows awareness) is the first step above the garbage pile.
  - Be the kind of author/scientist who pays attention to details!

Your Voice

- A key tenet of science is that true findings are true no matter who found them; we write with some personal distance from the content, and this establishes trust.
  - Never: *happily, our method worked better than the baseline*
  - Informal language and slang will deplete reader trust
- Readers suffer if all papers sound the same.
  - Consider clichés, tropes, catch-phrases, repetition, dry writing without variation, clumsy mimickry of science-like language
  - Some advise that you should never write a sentence that more than small-*N* people could have written.
  - Your scientific voice needs to be professional but also engaging.
  - Proofread by reading your paper out loud.
  - Pay attention to other writers' **style** when you read!
- Things will get more complicated/interesting when you are writing about ethical matters ("should" and not merely "is").

Summary

- If you remember nothing else from today:
  - Write for your **readers**, not yourself
  - Identify your contributions
  - Use clear, concrete examples
  - Move from concrete to the abstract
  - Use precise language

Thanks To & Further Material

- Philip Resnik (UMD, Chris's PhD advisor)
- Simon Peyton Jones (MSR Cambridge)

  http://research.microsoft.com/en-us/um/people/simonpj/papers/giving-a-talk/giving-a-talk.htm

  [Bonus: how to give a research talk;
  how to write a research proposal;
  video of him talking about good writing]

  [*Several slides are taken from SPJ's posted talk*]

- Jason Eisner (JHU, Noah's PhD advisor)

  http://www.cs.jhu.edu/~jason/advice/how-to-write-a-thesis.html

Further Material

- Geoffrey K. Pullum (Edinburgh)

  http://www.lel.ed.ac.uk/grammar/passives.html

- Steven Pinker (Harvard), *The Sense of Style*